



CGIAR

**Consultative Group on
International Agricultural Research**

ANNUAL REPORT 1990

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Introduction

The year under review in this report saw the Consultative Group on International Agricultural Research (CGIAR) pull together a number of policy strands which were developed over the preceding two years. In weaving these strands together, the CGIAR established the basis for reorienting the programs of the CGIAR system.

From its inception, research supported by the CGIAR has covered commodities that provide some 80 percent of the food energy and of protein requirements in developing countries. The task of providing the world's poor with food security, and the range of connected benefits that accompany food security has not been completed. The contribution of CGIAR-generated technology, policy, and capacity building towards meeting this goal is, however, substantial.

As successful as the CGIAR has been in its pursuit of productivity-directed commodity research, the need became apparent during the second half of the eighties for a broadening of its approach.

First, the Group recognized that the pursuit of productivity gains through commodity-based research needed to be complemented by a capacity for research in natural resource management.

Second, in keeping with this view, the CGIAR developed a number of criteria by which the inclusion of an agricultural sustainability perspective in CGIAR research could be assessed. The final report of the CGIAR Committee on Sustainable Agriculture is summarized on the pages which follow.

Third, the Group decided that forestry and agroforestry research had to be associated with basic agricultural research and integrated into the system with benefits for both agriculture and forestry.

Fourth, the Group recognized that the full benefits of global scientific research—the breeding of new varieties—were unattainable without significant strengthening of national research institutions.

The attention focused on these issues culminated in a series of policy decisions with both conceptual and practical implications. In summary, the CGIAR decided that productivity-oriented research and natural resource management should be fully integrated within the CGIAR.

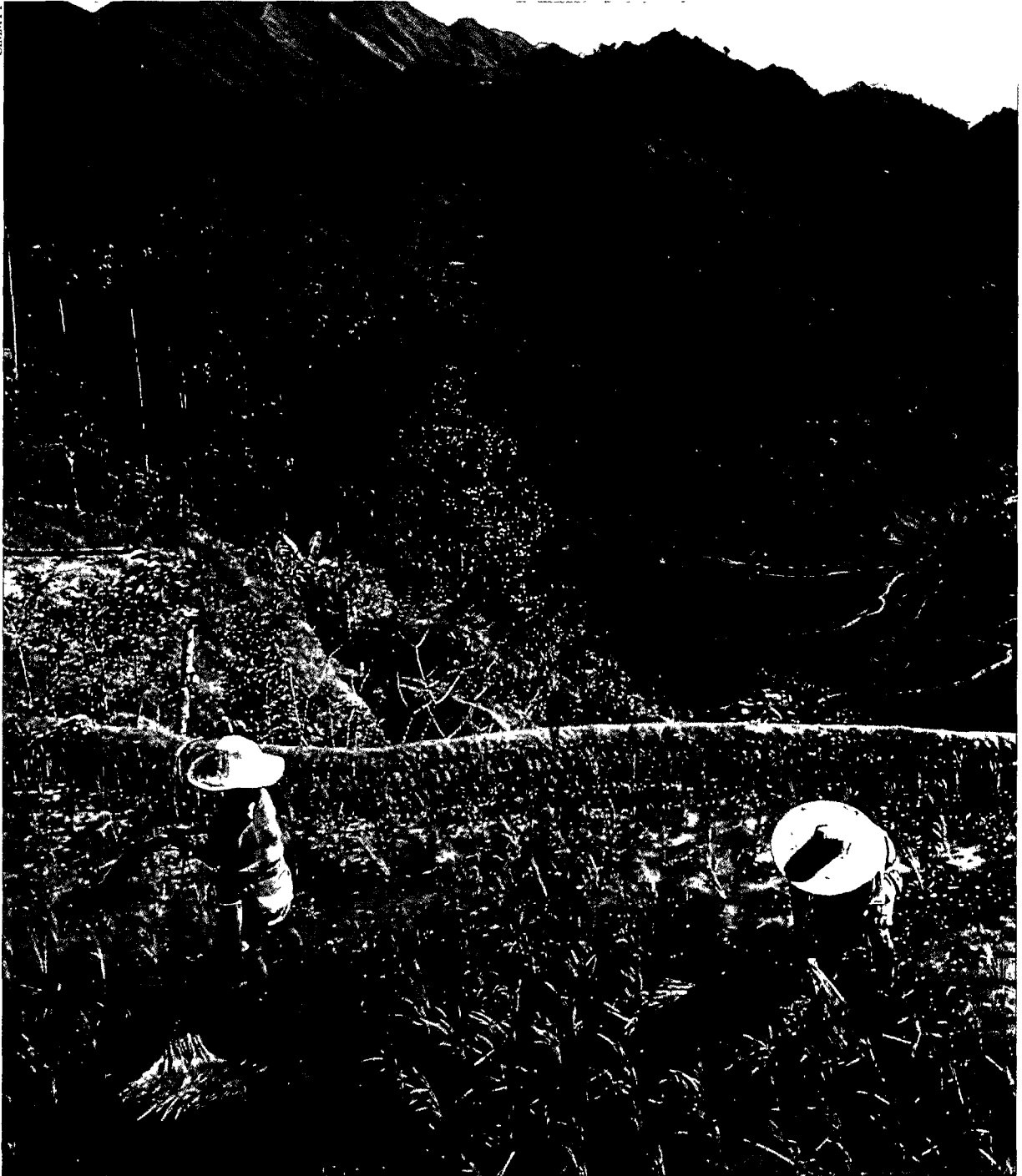
The CGIAR felt, moreover, that the further pursuit of natural resource objectives might best be achieved by the introduction of what is called an “ecoregional concept.” This would set productivity-oriented research into the context of specific ecological areas to better integrate environmental concerns.

The Group reaffirmed and strengthened the objective of support to national research organizations and, in particular, encouraged centers to operate in a networking fashion with national organizations.

Consequent to these decisions, the CGIAR began a program of expansion which will see the number of CGIAR centers rise from 13 in 1990 to 18 in 1992.

The substance of these changes and the process by which policy decisions were reached are outlined in this report. Clearly, the CGIAR remains vibrant and capable of confronting new challenges in the years ahead. These will include the task of mobilizing and allocating the resources required for a research program that can have a major impact on human development.

Alexander von der Osten
Executive Secretary



Transplanting rice in the northern Philippines.

The Consultative Group on International Agricultural Research (CGIAR)

The Consultative Group on International Agricultural Research (CGIAR) is an informal association of 40 public and private sector donors that supports a network of 16 international agricultural research centers. The Group was established in 1971.

CGIAR centers have trained over 45,000 agricultural scientists during the past 20 years. The types of training provided ranged from mid-level regional courses to post-doctoral programs at CGIAR centers. Many scientists from developing countries who were trained at CGIAR centers form the nucleus of and provide leadership to national agricultural research systems in their own countries.

International centers supported by the CGIAR are part of a global agricultural research system. The CGIAR functions as a guarantor to developing countries, ensuring that international scientific capacity is brought to bear on the problems of the world's disadvantaged peoples.

Programs carried out by CGIAR-supported centers fall into six broad categories:

- **Productivity Research**

Creating or adopting new technologies (such as the "dwarf" varieties of wheat and rice which brought about Asia's green revolution) to increase productivity on farmers' fields

- **Management of Natural Resources**

Protecting and preserving the productivity of natural resources on which agriculture depends

- **Improving the Policy Environment**

Assisting developing countries to formulate and carry out effective food, agriculture, and research policy

- **Institution Building**

Strengthening national agricultural research systems in developing countries

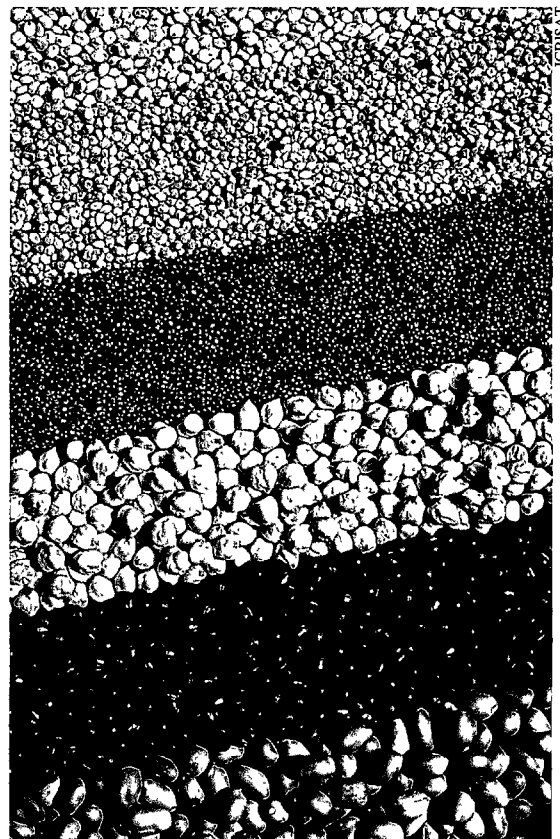
- **Germplasm Conservation**

Conserving germplasm and making it available to all regions and countries

- **Building Linkages**

Helping to create or strengthen linkages between developing country institutions and other components of the global agricultural system

Food productivity in developing countries has increased through the combined efforts of the CGIAR centers and their associates in developing countries. The same efforts have brought about a range of other benefits, such as increased farm income, reduced prices of food, better food distribution systems, better nutrition, more rational policies, and stronger institutions.



The centers have global responsibilities for more than twenty crops. Shown above are six of these; from top to bottom they are sorghum, pearl millet, finger millet, chickpea, pigeonpea, and groundnut.

CGIAR Centers

CIAT

Centro Internacional de Agricultura Tropical
Apartado Aereo 6713, Cali, Colombia. Founded 1967. Focus on crop improvement and improving agriculture in the lowland tropics of Latin America. Research covers rice, beans, cassava, forages, and pastures.

CIMMYT

Centro Internacional de Mejoramiento de Maiz y Trigo
P.O. Box 6641, Mexico 06600, D.F., Mexico. Founded 1966. Focus on crop improvement. Research covers maize, wheat, barley, and triticale.

CIP

Centro Internacional de la Papa
Apartado 5969, Lima, Peru. Founded 1970. Focus on potato and sweet potato improvement. Research covers potato and sweet potato.

IBPGR

International Board for Plant Genetic Resources
c/o Food and Agriculture Organization of the

United Nations, Via delle Sette Chiese 142, Rome, 00145 Italy. Founded 1974. Focus on conserving gene pools of current and potential crops and forages. Research covers plant genetic resources.

ICARDA

International Center for Agricultural Research in the Dry Areas

P.O. Box 5466, Aleppo, Syria. Founded 1975. Focus on improving farming systems for North Africa and West Asia. Research covers wheat, barley, chickpea, lentils, pasture legumes, and small ruminants.

ICRAF

International Centre for Research in Agroforestry

P.O. Box 30677, Nairobi, Kenya. Founded 1977. Focus on initiating and supporting research on integrating trees in land-use systems in developing countries.

ICRISAT

International Crops Research Institute for the Semi-Arid Tropics

ICRISAT Patancheru P.O., Andhra Pradesh 502 324, India. Founded 1972. Focus on crop improvement; cropping systems. Research covers sorghum, millet, chickpea, pigeonpea, and groundnut.

IFPRI

International Food Policy Research Institute
1776 Massachusetts Avenue, N.W., Washington, DC 20036-1998, USA. Founded 1975. Focus on strategies and plans to meet world food needs. Research covers all aspects of policy analysis.

IIMI

International Irrigation Management Institute
P.O. Box 2075, Colombo, Sri Lanka. Founded 1984. Focus on improving and sustaining the performance of irrigation systems through better management.

IITA

International Institute of Tropical Agriculture
PMB 5320, Ibadan, Nigeria. Founded 1967. Focus on crop improvement and land management



IRRI geneticist Susan McCouch crosses a wild rice with an improved variety. Wild rices are an immense source of insect and disease resistance that, when transferred to their domesticated relatives, can eliminate or reduce the need for pesticides.



The CIP potato collection has been reproduced for in vitro laboratory storage through advanced tissue culture techniques.

in humid and sub-humid tropics; farming systems. Research covers maize, cassava, cowpea, plantain, soybean, rice, and yam.

ILCA

International Livestock Center for Africa

P.O. Box 5689, Addis Ababa, Ethiopia. Founded 1974. Focus on farming systems to identify livestock production and marketing constraints in Sub-Saharan Africa. Research covers ruminants, livestock, and forages.

ILRAD

International Laboratory for Research on Animal Diseases

P.O. Box 30709, Nairobi, Kenya. Founded 1973. Focus on control of major livestock diseases in Sub-Saharan Africa. Research covers theileriosis (East Coast fever) and trypanosomiasis (sleeping sickness).

INIBAP

International Network for the Improvement of Banana and Plantain

Parc Scientifique Agropolis-Montpellier,

Bat 7-Boulevard de la Lironde, 34980 Montferrier-sur-Lez, France. Founded 1984. Focus on banana and plantain.

IRRI

International Rice Research Institute

P.O. Box 933, Manila, Philippines. Founded 1960. Focus on global rice improvement.

ISNAR

International Service for National Agricultural Research

P.O. Box 93375, 2509AJ, The Hague, Netherlands. Founded 1980. Focus on strengthening and developing national agricultural research systems.

WARDA

West Africa Rice Development Association

01 B.P. 2551, Bouake 01 Cote d'Ivoire. Founded 1970. Focus on rice improvement in West Africa. Research covers rice in mangrove swamps, inland swamps, upland conditions, and irrigated conditions.

New Directions in the CGIAR

As it closed out on its 20th year of effort and achievement, the CGIAR took a number of landmark decisions in 1990, all of them directed at strengthening the impact of international agricultural research on agricultural development in the world's less developed countries.

Agricultural technologies that would lead to increased agricultural productivity were a major preoccupation of CGIAR members when the Group was formally inaugurated on May 19, 1971. This emphasis was in response to stark assessments at the time that South Asia's food needs could not be met, and that the region was therefore doomed.

In 1990, with almost two decades of effort and achievement behind it, the Group decided at its annual meeting, International Centers Week (ICW90), that it should modify the substance of its policy and operations so as to strengthen the connections between productivity research and natural resource management research.

In a world where many millions go hungry, despite the great advances made by scientific agriculture, the need to increase food productivity remains pressing. At the same time, limitations

inherent in natural resource systems must be respected. One imperative cannot be enhanced at the expense of another. Producing more food will become a process that harms the human habitat if agriculture is pursued in a manner that harms the natural resources on which food production depends.

Accordingly, at ICW90, the Group formally recognized natural resource management as a twin pillar of CGIAR-supported research. The other pillar will continue to be productivity. In attempting to forge this synthesis, the CGIAR was once again providing leadership to the international research community, as it did in 1971. The intended beneficiaries of these new directions would continue to be the world's poor and disadvantaged.

Paving the Way

These decisions were based primarily on discussion of a report from the Group's Technical Advisory Committee (TAC) on "A Possible Expansion of the CGIAR." The report was the result of a two-year deliberative process which began when the Group decided at its 1988 mid-term meeting (Berlin, May 16-20) to "launch an exploration" as to whether or not to invite all or some of several international research centers outside the CGIAR system (described as "non-associated centers") into the CGIAR.¹

The examination was entrusted to the Technical Advisory Committee which set about its task in close collaboration with the CGIAR Secretariat.

1 The centers listed for review were:

AVRDC Asian Vegetable Research and Development Center

IBSRAM: International Board for Soil Research and Management

ICIPE: International Centre of Insect Physiology and Ecology

ICLARM: International Center for Living Aquatic Resources Management

ICRAF: International Council for Research in Agroforestry

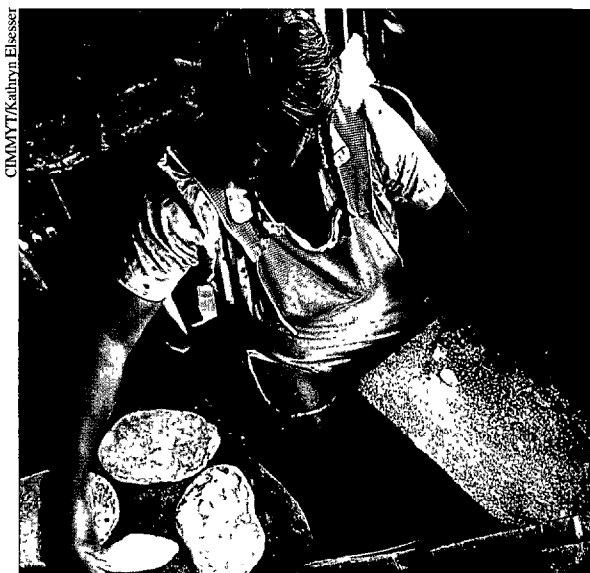
IFDC: International Fertilizer Development Center

IIMI: International Irrigation Management Institute

INIBAP: International Network for the Improvement of Banana and Plantain

ITC: International Trypanotolerance Centre

IUFRO: International Union of Forest Research Organizations



Making maize tortillas in Mexico.



IIMI/Matthew Driskill

Farmer-managed, terraced irrigation systems in mountainous Nepal.

All listed non-associated centers and the subject matter covered by them were reviewed. These inquiries were all conducted in the broader context of an effort by TAC, assisted by the CGIAR Secretariat, to redefine CGIAR strategies and priorities for the next decade.

As a result of these processes, a possible expansion of the CGIAR was the focus of attention at several levels of the CGIAR system in 1990. These included meetings of cosponsors, of an ad hoc committee of donors, meetings of CGIAR Board Chairs and Center Directors and of the Group itself. Expert panels set up by TAC and the CGIAR Secretariat formulated a number of policy options which were examined at all levels of the system, and particularly by TAC, before final recommendations were presented to the Group at International Centers Week.

Although this flurry of "expansionist" activity was a direct consequence of the Group's decision at Berlin, it was also contrary to some points of view previously expressed within the Group. In 1976, for instance, the first system-wide review of the CGIAR recommended that "the system

forego new additions for a period of three years so that existing activities could be consolidated." The second review of the system carried out in 1981 made a similar recommendation "on financial grounds."

The system grew, nevertheless, in response to specific needs. IFPRI became a CGIAR center in 1975 and ISNAR in 1980. But the Group was cautious in responding to suggestions from clusters of its members that the reach of CGIAR research should be extended into a number of areas such as aquaculture, forestry, fertilizer development, insect pathology, irrigation management, and vegetables. CGIAR members supporting such initiatives suggested that existing institutions should be incorporated within the system or that new institutions should be established as part of the CGIAR.

Despite the reluctance of the Group as a whole to support growth, several donors went ahead and formed or served as members of support groups for non-associated centers. Thus, the Group displayed a certain ambivalence on the question of expansion. As a CGIAR Secretariat report pointed

Research Centers Win Award for Biological Control of Food Pests

IITA and CIAT have achieved major success in the biological control of one damaging African food pest, and made progress towards controlling another.

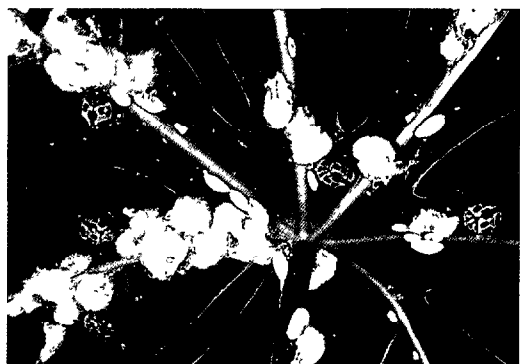
Success in controlling the cassava mealybug has benefited more than 200 million Africans for whom cassava is a staple food. The benefit: cost ratio of the cassava mealybug program has been calculated at 149:1, or \$149 worth of food saved for every \$1 of research or development invested.

For their work on biological control programs, IITA and CIAT won the CGIAR King Baudouin Award, which is given every two years to CGIAR-supported agricultural research centers for a technology or discovery that has improved the lives of farmers in developing countries.

In 1980, the CGIAR won the King Baudouin Prize for International Development, a prize established in commemoration of the first 25 years of the Belgian monarch's reign. The original prize of \$50,000 is held in trust. The CGIAR King Baudouin Award has ranged from \$6,000 to \$15,000 from earnings accrued. Winners are selected by members of the CGIAR Technical Advisory Committee.

Begun in 1977 to combat imported cassava pests, the IITA Biological Control Program, in association with CIAT, scored its first success by finding and introducing natural enemies to control the devastating cassava mealybug in the late 1980s. The IITA Biological Control Program's \$3.5 million Benin Research Station was opened near Cotonou in December 1988. The program had previously operated out of IITA headquarters in Ibadan, Nigeria. The cassava mealybug, which was accidentally brought to Africa from Latin America in 1971, caused crop losses of up to 80 percent.

A particularly effective parasitic wasp, *Epidinocarsis lopezi*, has been distributed by IITA and its many national program collaborators at over 150 sites in Sub-Saharan Africa countries and is bringing the cassava mealybug population below damaging levels.



Ladybugs, beneficial insects feeding on cassava mealybugs, illustrate IITA's research in classical biological control.

According to the director of the Benin Research Station, Hans Herren: "with biological control methods, no extensive pesticides are required, and the small-scale African farmers who depend on crops like cassava and mango to feed their families are freed of a damaging pest by nature itself."

Swift action against the mango mealybug, which three years ago threatened mango production across much of West and Central Africa, was patterned after the successful program against the cassava mealybug.

Control of this second imported mealybug pest, *Rastrococcus invadens*, has been made possible by close collaboration among national plant protection services in Benin and Togo, the British-based Commonwealth Institute of Biological Control (CIBC), and the IITA Biological Control Program.

A parasitic wasp which is a natural enemy of the mango mealybug has been released in five of the affected countries. About six months after the release, the mealybug population appeared to have dropped substantially.

Several affected countries where natural "enemies" were released in 1988 enjoyed a mango crop in 1989, following an almost total production loss during the previous two years.

Other food crop pests currently under study for biological control include the larger grain borer, a major pest of stored grains, locusts and grasshoppers, and the complex of cowpea pests. Certain weeds, such as water hyacinth and the parasitic witchweed, are also considered likely candidates for control by biological methods.

out in 1988, individual members of the CGIAR displayed considerable enthusiasm “for undertaking additional activities, while at the same time collectively expressing reluctance to do so.”

Several factors broke down that reluctance, leading to the Group’s decisions at Berlin. Among the most decisive of those factors were the following:

- Environmental concerns were growing more and more important on the global agenda. The “greening of policy” emerged as an activist slogan, drawing many adherents within the CGIAR system. The pressure of these ideas on development policy became stronger with the publication of the report of the Brundtland Commission.²
- In the areas of agriculture and agricultural research, environmental concerns were encapsulated in the phrase “sustainable agriculture,” a goal which environmentalists said should be espoused by the entire development community. Forestry emerged as an item of major importance in this discussion, creating both clashes and congruences of interest.
- Against the background of these developments, the CGIAR entrusted TAC with the responsibility of exploring how “sustainability” meshed with the work of CGIAR centers. The results of that study were embodied in a policy paper which found great favor among CGIAR members at Berlin. (At the request of members, a “popular” version was also produced.)³
- The growth of a global agricultural research system strengthened links between the CGIAR and non-associated centers — conceptually, in terms of shared commitments, and through personalities who moved back and forth between and among various centers.
- Donors who formed support groups for non-associated centers consistently sought to bring their “non-associated offspring” into the CGIAR family. Some supporters of that viewpoint

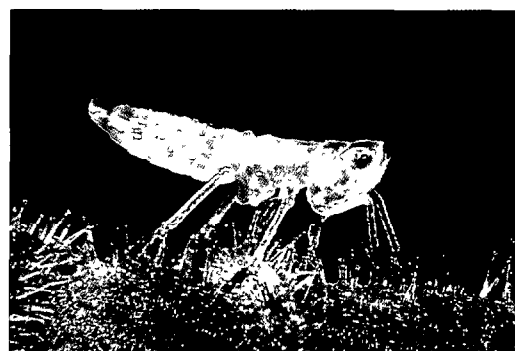
2 Report of the World Commission on Environment and Development, chaired by Gro Harlem Brundtland, Prime Minister of Norway

3. The full title of the report is as follows: *Sustainable agricultural production: implications for international research*, FAO research and technology paper 4

The full title of the popular booklet is: *Food—Today and Tomorrow*, published by the CGIAR Secretariat

argued that the resource-oriented emphasis of many non-associated centers naturally complemented the commodity-oriented emphasis of most CGIAR centers, and that a combination of the two elements was both desirable and inevitable.

These various factors coalesced at the Berlin meeting of the CGIAR when several agenda items impinged on natural resources/environment issues as well as on a broadening of the CGIAR system’s activities. Subsequently the Group decided at its 1989 mid-term meeting at Canberra that the mandate of the CGIAR should be expanded to include agro-forestry/forestry research.



Future Pesticide Reduction

Another center working to reduce the global pesticide load is CIP. A “hairy potato” developed by an international team of scientists from Cornell University, the Italian Center for Nuclear and Alternative Energy Sources near Rome, and CIP in Lima is expected to soon end 40 years of heavy insecticide use on one of the world’s most popular foods. The leaves and stem of the plant are hairy; these hairs, called glandular trichomes, form a physical and biochemical barrier that entrap and kill insects. At the same time they are harmless to humans and wildlife. The hairy potato, a descendant of a non-edible wild species from the Peruvian Andes, was combined with edible potatoes at Cornell as part of a long-term CIP research contract. Hybrids were then hybridized with Italian varieties that grow well in North Africa and other developing areas.



Philippine workers sorting abaca fibers for export as Manila hemp. Rural nonfarm employment will be a more significant research issue given the rapid growth in the rural labor force and population pressure on land. Research on food and nutrition security will shift from food consumption subsidies to the income earnings of the poor.

Moving Forward

Although the Technical Advisory Committee was asked to review non-associated centers for their possible inclusion within the system, the committee felt that it could not approach the task as a simple matter of recommending the inclusion or exclusion of new institutions. The committee saw the potential expansion of the CGIAR as the starting point for systemic restructuring. The basis of the changes proposed was an integrated approach which would apply to all aspects of the CGIAR, whether it be commodity research, the broad spectrum of natural resource management, or the agroforestry/forestry sector

Consequently, the report contained proposals for integrating agroforestry/forestry in the CGIAR system, a major expansion of the system, substantial restructuring of the system in the medium term, and for the long-term evolution of the system.

The report proposed that in the medium term, research supported by the CGIAR would fall into two clusters: global commodity activities and ecoregional activities.

GLOBAL activities would be focused on commodities and selected subject matter areas, such as policy, management, conservation of germplasm, and the maintenance of biodiversity.

ECOREGIONAL activities would focus on applied and strategic research on the ecological foundations of sustainable production systems, commodity improvement in collaboration with global commodity activities, and interaction with national partners.

Against the background of that analysis, separate recommendations were made on each of the non-associated centers it had reviewed.

In response, the CGIAR:

- endorsed the concept of ecoregional activity within the CGIAR system as a means of merging productivity concerns with natural resource management;
- called for a continuing examination of a series of natural resource management themes—such as the relationship between soil and water, soil fertility, plant protection—and of the institutional changes required to ensure that those

themes were encompassed in CGIAR-supported research;

- decided that a number of commodities of particular importance for poor people should be included in future research programs within the CGIAR framework; and
- emphasized that the full benefits of international agricultural research could not be attained unless national agricultural research systems were significantly strengthened.

The immediate consequence of these decisions was that two non-associated centers joined the CGIAR system. The new centers are the Colombo, Sri Lanka-based International Irrigation Management Institute (IIMI) and the International Network for the Improvement of Banana and Plantain (INIBAP), headquartered near Montpellier, France. To ensure that agroforestry and forestry research is firmly established within the CGIAR, two entities will be admitted into the system—the International Council for Research in Agroforestry (ICRAF) in Nairobi, Kenya, and a new institution, as yet unestablished.

The Group also broadly agreed that vegetables research should be supported by the CGIAR, and recognized the global contribution that has been made by the Asian Vegetable Research and Development Center (AVRDC) based in Taiwan. At the same time, however, the group appreciated the need for political developments to mature before any final decision could be made on bringing AVRDC into the CGIAR system.

Over the long term, the CGIAR would be a smaller, service-oriented enterprise and much less of a hands-on applied research system. When that stage was reached, more work would be undertaken by national research systems.

The Group decided as well that the emphasis on “increasing sustainable food production” in the mission statement of the CGIAR should change to an emphasis on food self reliance in the developing regions of the world. “Food self reliance” was defined as the capacity of a nation to provide a sufficient stable food supply to all of its inhabitants, either from domestic production or from the production of exportable goods to enable commercial imports to cover the domestic deficit.

The new mission statement of CGIAR reads as follows: “Through international research and



IIMI/Bob Cowell

Irrigation often plays a major role in vegetable production.



ICRAF

Pearl millet is the sixth most important cereal in the world and the most widely cultivated millet in the semi-arid tropics.

related activities, and in partnership with national research systems, to contribute to sustainable improvements in the productivity of agriculture, forestry, and fisheries in developing countries in ways that enhance nutrition and well-being, especially among low-income people.”

Gender Issues

Given that the CGIAR system seeks to increase the amount, quality, and stability of food supplies for the poor in low-income countries, it is essential to identify correctly those who contribute to and benefit from agriculture. There is a growing awareness that women play a major

role in agriculture, particularly in food production, and that gender-sensitive analysis is valid in defining the differences between male and female farmers as well as among women farmers.

And as more women enter the workforce, it becomes important to assess who will be the end users of agricultural research and whether poor farmers and households will possess the opportunities and resources to adopt improved technology.

Gender issues have been discussed at various times by the Group. Recent requests from several donors for more emphasis on these issues led to the preparation and presentation of a paper by Susan Poats at the 1990 mid-term meeting.

"Gender Issues in the CGIAR System: Lessons and Strategies from Within" addressed the history of gender issues within the system including past recommendations, gender issues in the donor community, an analysis of why gender issues do make a difference and why the gender issue is so difficult, strategies already in place within the system, and suggestions for the next steps the system can take.

Poats listed five steps which included recommendations to the donors, TAC, and the centers. "Donors to the CGIAR system must exert pressure upon the system to adopt an explicit gender perspective and incorporate gender analysis in the research agenda." During the center review processes two aspects of gender



IBPGR germplasm collector Helen Moss in Namibia. The results of her work will ultimately end up in a germplasm storage facility.

This central mission requires the following nine goals or priority areas for action:

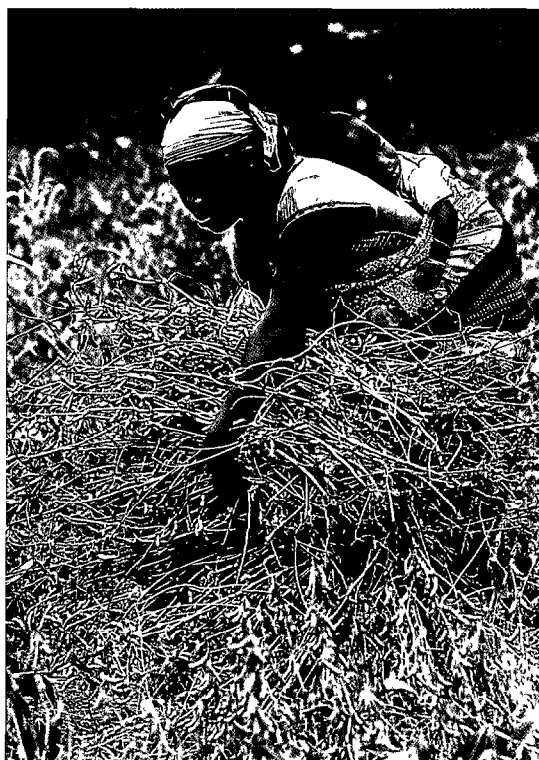
- 1) effective management and conservation of natural resources;
- 2) improved productivity of important crops and their integration into sustainable production systems;
- 3) improved productivity of important livestock and their integration into sustainable production systems;
- 4) improved production of important trees and their integration into sustainable production systems;
- 5) improved productivity of important fish and their integration into sustainable production systems;
- 6) improved utilization of agricultural, forestry, and fish products in both rural and urban areas through improved post-harvest technology;

are important; evaluating whether gender is being used “as an analytical tool in the description of problems, the design and testing of new technology and in the examination of impact on clients and beneficiaries”; “review teams must look at the gender of the staff of the centers to see the extent to which women are present at each level and within the various programs.”

Center staff need to learn how to incorporate gender analysis into relevant parts of their research and programming. Gender issues training for center staff should encompass sensitization and awareness, gender analysis methods, and training the trainers so that the gender perspective becomes a part of all center training programs.

Centers should use existing networks to develop common themes and methods for incorporating gender issues. This will also help to strengthen the linkage with the NARS and reinforce this issue at the national level. And finally the CGIAR should develop a strategy paper which includes center-specific strategy statements.

As a follow-up to the discussions at the mid-term meeting and in response to donor requests, a proposal was submitted to donors for specific action on gender issues. This proposal contained the following initiatives: publication of a CGIAR Strategy Paper on gender; sensitizing IARC staff to the importance of the user perspective and gender in technology development; strengthening IARC training for NARS in



ITA/Benson Fadane

Nigerian farmer harvesting her soybean field.

gender issues and analysis; sensitizing IARC managers and senior staff on how employees' attitudes and institutional culture support or deter women in the centers; and guidance for IARCs on affirmative personnel policies. The Strategy Paper is likely to be presented at the 1993 mid-term meeting.

- 7) improved diets, family welfare, and equity (including gender equity) through better understanding of the human linkages between production and consumption;
- 8) appropriate policies for increased productivity in agriculture, food, fisheries, and forestry and for the sustainable use of natural resources; and
- 9) strengthened institutions and human resources in national research systems to accelerate the

identification, generation, adaptation, and utilization of technological innovations.

Although, superficially, the expansion of the system could be viewed as a “numbers game,” what the Group actually attempted in 1990 was a renewal and redirection that could influence the trends of international agricultural research in the decades ahead as decisively as CGIAR policies had done in years past.

The Concept of Sustainability in the CGIAR

Les Swindale, Chairman of the CGIAR Committee on Sustainable Agriculture set up in 1988, presented his final report to the mid-term meeting of the Group held at The Hague, in May 1990.

The report examined the main sustainability issues which concerned international centers: protecting the genetic base, dealing with soil degradation, addressing variations in climate, maintaining pests and nutrients in ways that would reduce the use of agricultural chemicals.

The report went on to deal with such issues as long-term sustainability research and trials, how to measure sustainability, and how to institutionalize a concern for sustainability throughout the CGIAR system.

Mr. Swindale said that CGIAR centers already recognize that a sustainability perspective must become an inherent part of what they undertake in the future. They were doing much with existing resources and would do more if or when additional funding was available.

It was clear from the medium-term plans of the centers that they had moved resolutely in the sustainability area in recent years. Their future plans for sustainability-related research at the centers read very differently from those of 10 years ago. The centers would in particular emphasize research in areas where improving sustainability and increasing food production went hand-in-hand.

Mr. Swindale said the committee felt it had completed its task, and should therefore be disbanded. The responsibility for following up the committee's recommendations will rest with center directors.

The Group commended Mr. Swindale and his colleagues on the committee for the clarity and forthrightness with which they had analyzed and articulated the issues. They stressed that heightened awareness of environmental concerns which had resulted in the establishment of a sustainability committee in the CGIAR, and the momentum of interest created by the committee itself, should not cease. The compilation of the committee's report should not be

seen as the end of a process but as a beginning from which the entire system could move forward to meet the challenges ahead.

Sustainability issues were currently of such paramount concern that the CGIAR system had to make it manifestly clear by its approach and its actions that it considered natural resource management as important as increasing food productivity. Sustainability, it was pointed out, is the main issue for the nineties.

In the special report that follows, Mr. Swindale reviews several aspects of sustainable agriculture in relation to the work of CGIAR centers.

A sustainability perspective is clearly discernible in the work of CGIAR centers. This is to be expected because since its inception, the CGIAR has indicated a strong inclination toward low-input agriculture, biological methods for controlling pests and diseases, and improved methods for dealing with edaphic and climatic stresses. In serving the farmers of developing countries, the centers focus on low-cost sustainable technologies.

Furthermore, in recent years the centers have taken substantial steps in response to increasing internal and external (donor community and general public) concerns about sustainability. Several important general points characterize these responses:

- All international agricultural research centers (IARCs) carry out significant research relating to the sustainability of agriculture. Their particular research efforts are dependent on their livestock, regional and resource mandates. Most have firm plans to increase the scope and level of such work.
- Three broad sets of factors are identified by the IARCs as determinants of sustainability. Physical determinants such as soil, water, and climate account for nearly 50 percent of all research activities. Secondly, 32 percent relate to biological determinants such as animal health, genetic resources, and crop pests and diseases. Lastly,

19 percent is devoted to socioeconomic determinants such as population, prices, and policies.

- The level of intervention varies widely among centers and in complexity. Generally, research relating to the physical determinants of sustainability clusters at the production level. Research relating to the biological determinants centers more on the cellular, organism, and community of organisms levels, and that relating to the socioeconomic determinants tends to emphasize farm, national, and ecosystem levels.
- Research related to socioeconomic determinants is heavily concentrated on technology issues, with nearly half of all IARC activity in this area addressing either technology evaluation or technology policy concerns. There is a notable dearth of research on population, institutional or economic policy issues relating to sustainability.
- Among the CGIAR centers, sustainability is particularly important for centers with regional mandates such as CIAT, ICARDA, ICRISAT, IITA, and ILCA with environments limiting agricultural potential such as humid tropics, dry areas, or steepplands. In such areas, virtually all agricultural research projects must face the test of sustainability at their outset due to climatic and soil conditions which leave little margin for extractive or high-risk techniques. The IARCs with a natural resource mandate such as IBSRAM, ICRAF, ICIPE, and IIMI have research programs that focus on sustainability issues.

Major Sustainability Issues Addressed by the Centers

Soil Degradation

As it spans all the commodities, regions, agro-ecological zones, and natural resource systems that comprise the research agendas of the major IARCs, the problem of soil degradation clearly emerges as the most significant threat to sustainable agriculture. Some combination of soil erosion, deterioration of structure, loss of nutrients, build-up of salts or other toxic elements, water-logging and aridification leads to the diminution of the soil's biological capacity in virtually every agricultural area of the developing world. IARCs



Thousands of hectares of virgin forest are being cleared for agriculture in Paraguay and throughout the world.

have been forced to address this threat through breeding (e.g., for saline tolerance), additional inputs, or shifts in cropping emphasis. However, among commodity-based centers, as well as those focusing on agroecological areas, the perception that such "micro-adjustments" are not sufficient in many areas is growing. It is held that sustainability will depend increasingly on improved soil and water management at the farming systems and national levels.

Soil degradation resulting from the clearing of tropical rain forests is a serious problem affecting the integrity of the tropical ecosystem and the world's atmosphere. The efforts of CIAT in the Amazon, IITA in West Africa, and IBSRAM, in association with other institutes in a global network, are notable.

Loss of Genetic Diversity

The IARCs universally perceive the erosion or narrowing of the genetic base as one of the most significant threats to agricultural sustainability.



In Pakistan, IIMI staff member talks with an irrigation agency researcher while an agency field staff member measures tubewell height.

Viewed as increasing the risks of collapse in the sustainability of agricultural systems under IARC jurisdiction are the inherent increases in vulnerability that have accompanied the introduction of a few similar varieties of improved cultivars over large areas, and the potential loss of natural variability and primitive land races. While focusing on germplasm collection and research, most centers are seeking to reduce this risk by stepping up efforts to build well-preserved, pathogen-free germplasm banks with a full genetic range of improved and native species.

Variations in Climate

There has been some concern among climatologists and agricultural scientists about an adverse change in rainfall patterns in some parts of the world—an example is the Sahelian Zone of West Africa. This region's decreasing rainfall and devastating, recurrent droughts of the 1970s and 1980s led to many climatic studies. Whether

these are permanent irreversible trends, short-term irregular fluctuations, or components of long-term cycles has not been fully established. While one study concluded that there appears to be no identifiable trend associated with these decreases of rainfall, another concluded that the wettest month in West Africa has recorded a persistent decrease in rainfall in the recent past. Decreases in rainfall and persistent droughts leading to desertification have dire consequences for sustainability of agriculture in this region, and are therefore common concerns of those IARCs working in these fragile agroecological environments.

Rainfall varies according to time and place. Moving from higher to lower rainfall zones increases the coefficient of variability of rainfall. As rainfall decreases, the risks associated with cultivation of crops increase. Stabilizing production of agricultural commodities in these low rainfall environments is not only a question of sustainability of agriculture but also sustainability of human societies associated with them. A good example of agricultural production under a low rainfall regime is farming in Sub-Saharan Africa, particularly in the Sahelian Zone. The stabilizing of Sub-Saharan production by decreasing year-to-year yield fluctuations is the clearest way of achieving sustainability of agriculture. Escaping the risks associated with variable rainfall in low rainfall zones can be achieved by a host of methods: breeding short-duration drought resistant cultivars, using crops with high water use efficiencies, improving residue management, and employing other measures aimed at improved water management.

Maintaining Growth in Productive Agricultural Systems

All physical and biological systems are subjected to a common law of nature—output in some manner depends upon input. Agricultural production systems being both physical and biological adhere to this principle. Inputs in the case of agriculture are cultivars, fertilizers, agrochemicals, light, water, and management. The output is yield. The proportionality constant between input and output for any production system may vary widely. Agricultural scientists face the challenge of creating as large a proportionality constant as possible. Consequently, a specific quantity of input is multi-



Research by WARDA scientists confirms higher rice yields can be achieved by increasing nitrogen to rice growing soils through incorporating Azolla.

plied many times over as output. This is indeed the objective of much of IARC research.

The production systems for irrigated rice and wheat long regarded as the CGIAR's most visible successes are also its main examples of high-input production systems. Maintaining their productivity is important for the world's supply of food. Increasing the genetic potentials for yield of the mandate crops, improving fertilizer and water use efficiencies, making crops and animals resistant to diseases and pests, and improving the designs of irrigation systems are the IARCs' contributions to this goal. The basic strategy is to maintain growth in productivity while reducing the harmful side effects of high-input systems wherever necessary in the developing world.

Pest and Nutrition Management

Pests and diseases reduce crop yields. Their control in much of the developed world has been through the use of agrochemicals. But agrochemical use is costly to small farmers and can be unsafe. Where they are used unwisely, pests can become resistant. Excessive use—due to ignorance in most instances—is environmentally hazardous. Part of the plant breeding philosophy for all commodity-based IARCs has been to try to develop crop cultivars inherently pest and disease

resistant. Not all pests and diseases, however, can be controlled by this approach which usually loses its efficacy over time. In response to these concerns, centers have been increasingly emphasizing integrated pest management which strategically combines genetic, biological, agronomic, and chemical approaches. Integrated pest management is sustainable over time and least damaging to the environment.

A somewhat similar strategy of integrated nutrient management is receiving increased attention in several IARCs. It is aimed at reducing the dependence on chemical fertilizers while simultaneously increasing the effectiveness of organically supplied nutrients.

Promoting Change in Less Productive Systems

In the many marginal areas of the developing world—humid forests, drylands, extensive rangelands, most uplands, and hills—low-input agriculture has been practiced for centuries. Most centers devote significant attention to improvements in such low-input systems. They are concerned with accurate appraisals of the resources available, water use efficiency, nutrient cycling and residue management, low tillage systems, vegetative measures for soil conservation, and improving

the efficiency and yield potential of traditional cropping and grazing systems. Farming systems approaches such as agroforestry are much in evidence and becoming increasingly important.

Often there exists no alternative to low-input systems. Such systems can, however, increase income and ecological sustainability if farmers are able to utilize improved farming methods or advanced genetic varieties and are assisted in the substituting of purchased inputs by management expertise.

Gaps in Current Center Activities

While most centers have made considerable progress in identifying their particular, mandated sustainability concerns, subsequent activities do not yet constitute a concerted strategy oriented around a set of global and regional priorities. In short, the micro issues of sustainability are being well



This manually operated grinder with sifter developed at IITA can be used to grind cassava or yam chips into flour, pulverize dried cassava starch flakes, or grind dried cereal grains and vegetables.

addressed by the centers while the broader strategic questions cutting across the work of many centers are now largely dealt with through ad hoc cooperation. In particular, the centers recognized that they must act expeditiously and in cooperation to fill major gaps in the spectrum of possible research areas for sustainable agriculture.

Measurement and Long-Term Studies of Sustainability

The difficulty in developing an agreed-upon definition of sustainable agriculture points to a major task remaining: to develop practical and quantifiable indicators by which sustainability can be measured. There is universal agreement on the need for longer-term studies pertaining to the contributing factors of sustainable agriculture, as well as the need for developing shorter-term measures of sustainability. The unaddressed issues include who should do it, how it should be done, and who will finance it. Sustainability must become an operational concept which can help guide IARC priorities.

Sustainability of Emerging Farming Systems

Farming systems evolve with changing demographic profiles and economic circumstances. It is insufficient to ensure the sustainability of an existing low-intensity, labor-short farming system that will eventually evolve into a more intensive, labor-abundant farming system. There is little evidence that the centers are undertaking any significant body of research along these lines. This issue of emerging farming systems redoubles the urgency of developing measurable definitions of sustainability in agriculture. In short, IARC efforts to meet one priority, lowered inputs, may conflict with a second priority, future agricultural sustainability. Critical is the providing of farmers with accurate, readily usable information about how adaptation of low-input methods will likely affect sustainability: long-term soil productivity, farm profit margins, level of environmental externalities generated, and labor requirements. This research is likely to prove methodologically complex because the net result of specific changes in farming methods for agricultural sustainability cannot be anticipated without extensive informa-



Norman Borlaug teaching seed selection in a CIMMYT training workshop at Obregon, Mexico.

tion on variables throughout the whole farming system. To ensure the accuracy and usability of such research results, the design and implementation phases must emphasize a multidisciplinary and multiorganizational approach; incorporating the participation of farmers, public agencies, and private organizations.

Farmer Responses to Changing Sustainability Needs

Many studies have documented the elaborate adaptations undertaken by small farmers in order to increase production in response to changing environmental or ecological circumstances. At the same time, much of the failure to maintain sustainable agricultural systems in certain environments (e.g., tropical moist forest and semi-arid zones) can be attributed to the fact that traditional low-level systems of utilization have broken down in the face of population growth, political change, or socioeconomic trends. Further, there have not been appropriate higher production systems to take their place.

Efforts by IARCs to develop and introduce improved germplasm materials and appropriate packages of inputs within a sustainable farming system will need to be based increasingly upon an understanding of the process by which farmers adjust to

changes in external environmental circumstances. Farming systems research merits re-emphasis.

Rehabilitation of Degraded Lands

There is a growing need to address the challenges of rehabilitating lands that have lost their agricultural potential. Often such rehabilitation is dependent upon: (a) the development of a national political will to remove the source of excessive exploitation, thereby allowing natural regeneration, or (b) major structural repairs or the construction of large infrastructure such as dams and irrigation systems. The IARCs are unlikely to play a major role in such cases. However, germplasm improvement and field trial research undertaken by IARCs could lead to considerable advances in the availability of technology and knowledge for promoting biological processes which can enhance efforts to regenerate the productive capacity of the lands themselves.

This is likely to be a subject of increasing concern to NARS in key countries where large amounts of arable land are currently being removed from production as a result of land degradation. In fact, valuable IARC programs to screen plants for nitrogen-fixing, soil stabilization, moisture retention, and other regenerative qualities might begin by reviewing the experiences

of NARS and other national organizations. In countries such as India, major efforts are already being made to rehabilitate degraded lands.

Trees in Farming Systems

In order to maintain and improve soil productivity in fragile soils of rainfed areas with limited availability of inputs, several IARCs have promoted the introduction of small trees and shrubs (usually woody legumes with nitrogen-fixing ability) into traditional cropping systems. Long-term evaluation of these techniques has indicated that in many cases, other determinants being equal, sustainability is enhanced by soil productivity maintenance. The introduction of woody species also further enhances sustainability at the farm systems level by providing fuelwood, browse for livestock, and building materials.

Forestry techniques can be especially important in enabling resource-poor farmers to intensify land use in circumstances where size of landholdings is decreasing and in reducing the demands for costly farm labor and management. In addition, poor farmers are likelier to turn to agroforestry when farm sizes fall below that required to support basic household food needs. Often at this point, income generation from on-farm and off-farm activities becomes crucial to smallholder sustainability.

Long-Term Issues for the International Centers Relating to Sustainability

Opportunities for Cooperation Among Centers

Such major issues as soil degradation, genetic resources, maintaining high-input systems and improving low-input systems provide opportunities for cooperation among centers. ICRAF, ICRISAT, IFDC, IITA, and ILCA for example are cooperating in the development of sustainable, low-input, millet-based cropping systems in the Sahel. ILCA, ILRAD, and ITC are cooperating in the development of animal production in tsetse-infested areas. IBSRAM, CIAT, and IITA are working on improving the productivity of acid soils in humid areas.

Achieving sustainable agricultural production in broad agroecological zones inevitably requires the working together of several IARCs. Donors

and NARS increasingly require focus on a total package of crops, technologies, and inputs necessary to maximize incomes. They want to know not only what IRRI or WARDA can provide in helping make upland rice more productive and sustainable, but also what the other commodity alternatives are in the same highland areas.

Role of Biotechnology

The centers have addressed the potential role of biotechnology by agreeing that innovations in this area will contribute to sustainability by raising productivity and lowering inputs. They recognize that future biotechnology research could also offset or help to offset such major threats to agricultural sustainability as soil degradation and the erosion of genetic resources. But a more explicit effort to integrate the sustainability dimension into center biotechnology agendas is needed. The importance of the latter becomes critical as private sector advances in biotechnology, generally driven by market forces and corporate strategic planning factors, mitigate against a sustainability focus.

Opportunity Costs of Sustainability Focus

The fundamental objective of the CGIAR is to raise farmer productivity through the generation and dissemination of improved technology. Like equity and poverty alleviation concerns, long-term sustainability issues are important criteria for guiding strategic choices about priority problems to be addressed and solved. As governments are continually judged on the basis of their ability to maintain levels of major food crops, long-term sustainability is often sacrificed for current higher yields. Current higher yields could mean the difference between food security and deprivation for millions of poor people.

Neither short-term production goals nor agriculture sustainability can be viewed as a single-minded goal. Either instance would greatly reduce the flexibility of NARS and IARCs to meet urgent priorities or to pursue a transitional strategy through prudent introduction of a phased series of agricultural activities.

Helping Nations Address Sustainability

The centers recognize that they must give high priority to strengthening the capacity of NARS to incorporate sustainability perspectives into

Biotechnology

The CGIAR system currently spends 4.5 percent of its annual budget on research relating to biotechnology, which holds out the possibility of accelerated progress in plant and livestock breeding. Some two-thirds of this amount is spent on animal research, and a third on crop improvement.

CGIAR centers see themselves as facilitators which can help national agricultural research systems form linkages with advanced research institutions working on biotechnology issues. Given the potential significance of biotechnology research to plant and animal production, directors general of CGIAR centers reviewed the work undertaken by CGIAR centers and produced a report entitled "Biotechnology in International Agricultural Research Centers of the CGIAR." Presenting the report to members of the Group, Don Winkelmann, Chairman of the Center Directors Committee in 1990, noted the complementarity between biotechnology and conventional technologies and the essential need in this rapidly developing area to provide efficient transfer of technology from generation through to implementation. The report covered issues such as patents and intellectual property rights and the important issue of biosafety, which will be discussed in greater detail and given increased attention in the future.

A balance between biotechnology and conventional research is considered crucial to the role of the CGIAR in the sustainable improvement of agricultural productivity in developing countries. Thus, CGIAR centers use relevant tested biotechnology for more efficient resolution of issues on their research agendas. The well-established linkage strategy of the centers coopting and passing on research techniques to national systems will also be a way forward in biotechnology.

Biotechnology is monitored within the CGIAR by BIOTASK, a donor-led CGIAR Task Force on Biotechnology. BIOTASK's objectives are "to raise awareness within the



A molecular biologist at ICRISAT extracts DNA from pearl millet cells. The DNA is then digested by restriction enzymes to permit restriction fragment length polymorphism (RFLP) analysis.

CGIAR system on the issues involved in the integration of modern biotechnology in center programs and possible effects on national research systems."

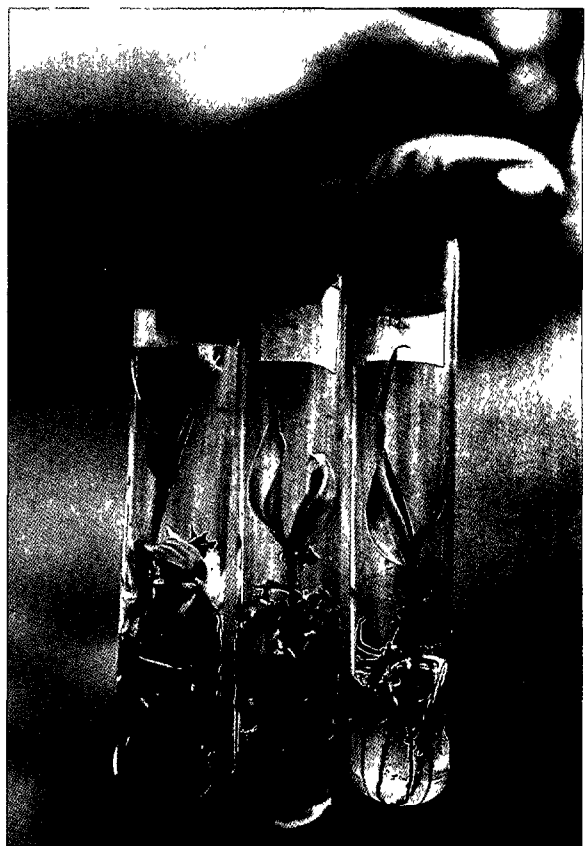
To achieve this objective, BIOTASK members will focus on a number of actions. For example, in the information area, they will attempt to persuade industrialized countries to meet the costs of providing developing countries with journals and other source materials. Several symposia supporting their objective have been held or are planned which cover the use of mapping techniques in plant breeding, cassava biotechnology, and biosafety. BIOTASK has emphasized the need for all commodity centers to adopt institutional biosafety committees and/or guidelines on the experimental use and environmental release of genetically engineered organisms.

their work. The success of research related to sustainability will ultimately depend on the commitment and effectiveness of the national systems. The centers recognize that the spread of agriculture into areas of marginal and low fertility soils or of extreme topographic or climatic conditions, coupled with the growing need to develop input lowering technologies which meet the needs of poor farmers adds to the urgency of strengthening the capacity of NARS. Technological innovations that hold promise for contributing to sustainability need to be adapted to a widening variety of localized ecological and social concerns. Sustainability may not be perceived to be a major issue by NARS currently preoccupied by the need to secure short-term production increases in the face of increasing populations and improving living standards. However, the acceptability of the gradual decline in soil fertility, for example, does not mean its irreversibility. This may be stated explicitly as a planned phase of the strategy to accommodate first the short-term necessity of growth, and second, the sustainability questions. There are innumerable examples throughout the developing world, where farmers have recognized that they must enhance the productivity of their land and conserve it if they are to continue to farm. Sustainability is by no means always a trade-off.

Many sustainability issues in agriculture are also environmental issues of national and international concern. They must be studied and remedial action taken through enlightened governmental and, in some cases, inter-governmental policies. Universities with their intellectual freedom and academic insights could be partners in investigating the broader issues of sustainability in relation to the environment. Cooperation among NARS, IARCs, and developing country universities could evolve into a powerful system that not only generates technological solutions to sustainability issues, but helps bring about public awareness and necessary policy changes. Such a three-way partnership does not exist today.

Conclusion

In an age when agricultural research is becoming increasingly politicized through the use of polarizing classifications such as low-input and high-input, chemical farming and organic farming, the



These plantain plantlets in test tubes are an example of IITA's micropropagation techniques to multiply cultivars for easy and safe transportation across borders.

IARCs believe that centers should view the concept of sustainability as a guide to the introduction and development of agricultural techniques and technologies. IARC research and other activities should seek to maximize output and increase efficiency in the use of inputs, while minimizing both the extraction of nutrients and organic matter from the soil and environmental contamination. The challenges will vary greatly according to environmental, economic, and social conditions, but the essential tasks for all the centers must be to determine the appropriate balance based upon scientific research, field experimentation, and measurements of farming systems and their associated components. Production of quality genetic materials and food through basic scientific work on the physical, chemical, and biological processes involved in plant and animal growth, remains the critical contribution IARCs can make to the objective that must underline sustainable agriculture: achieving more production per unit of land and input at less total energy and environmental cost.

CGIAR Finances–1990

Funding

Contributions to the CGIAR in 1990 from donors amounted to \$286.3 million, of which \$234.9 million were core funds and \$51.4 million were for complementary programs (Table 1). These figures represent nominal increases of 5 percent and 9 percent respectively over 1989 contributions. In addition to donor contributions, \$2.5 million was transferred to centers from the stabilization fund and about \$19.5 million was generated through various mechanisms at the centers. Total funding available to the centers in 1990 was \$308.3 million. This was \$12.3 million or 4 percent more than the \$296 million available in 1989. Factoring in an estimated systemwide 4.8 percent cost increase in 1990, this represents a decline in constant dollar terms of 1 percent.

At mid-year 1990, core funding was estimated at about \$235 million as reported at ICW 1990. Uncertainty about the system's funding prevailed throughout the year due to, on the one hand, contributions of a number of donors being below expectations, and on the other hand, the fluctuation in exchange rates which resulted in gains (about \$10 million) in the US\$ value of non-dollar contributions. In addition, delays in disbursements of some contributions exacerbated the centers' cash flow situation.

Of the \$234.9 million contributed for core programs by 33 donors by year's end, 69 percent was provided by country donors, 30 percent was provided by international/regional organizations, and the remainder was from two foundations (Annex 1 and Figure 1). The average contribution was \$7.1 million compared to \$6.2 million in 1989 when there were 36 donors. Of the core funds \$194.5 million or 83 percent were unrestricted; \$40.4 million or 17 percent were restricted to specific projects. The donors also contributed \$51.4 million to the centers' complementary programs which are highly restrictive. In contrast with the 1989 experience, complementary program support grew faster in 1990 than the core funding. About \$7.7 million of the complemen-

Table 1 CGIAR Core Funding by Center, 1988-1990 (in US\$ millions)

<i>CENTER</i>	<i>1988</i>	<i>1989</i>	<i>1990</i>
CIAT	24.4	28.4	27.7
CIMMYT	25.9	27.9	27.1
CIP	17.8	18.6	16.9
IBPGR	5.9	7.1	7.0
ICARDA	17.3	18.4	18.7
ICRISAT	26.0	30.1	31.5
IFPRI	8.7	8.8	9.1
IITA	21.1	22.0	22.5
ILCA	16.5	20.3	20.2
ILRAD	12.6	13.4	13.6
IRRI	26.5	26.6	29.8
ISNAR	6.8	7.5	7.0
WARDA	5.4	6.1	6.2
Subtotal	215.0	235.2	237.4
Stabilization Fund ^a	-3.4	-10.7	-2.5
Total Core Contributions ^b	211.6	224.5	234.9
Percent Increase	5%	6%	5%
<u>Memo:</u>			
1. Complementary Contributions	49.8	47.3	51.4
2. Total Contributions	261.4	271.8	286.3

a. The Stabilization Fund buffers centers' budgets against fluctuations in exchange rates and inflation rates

b. In addition to donor contributions, centers also finance programs from self-generated income, carry-overs, and changes in working capital.

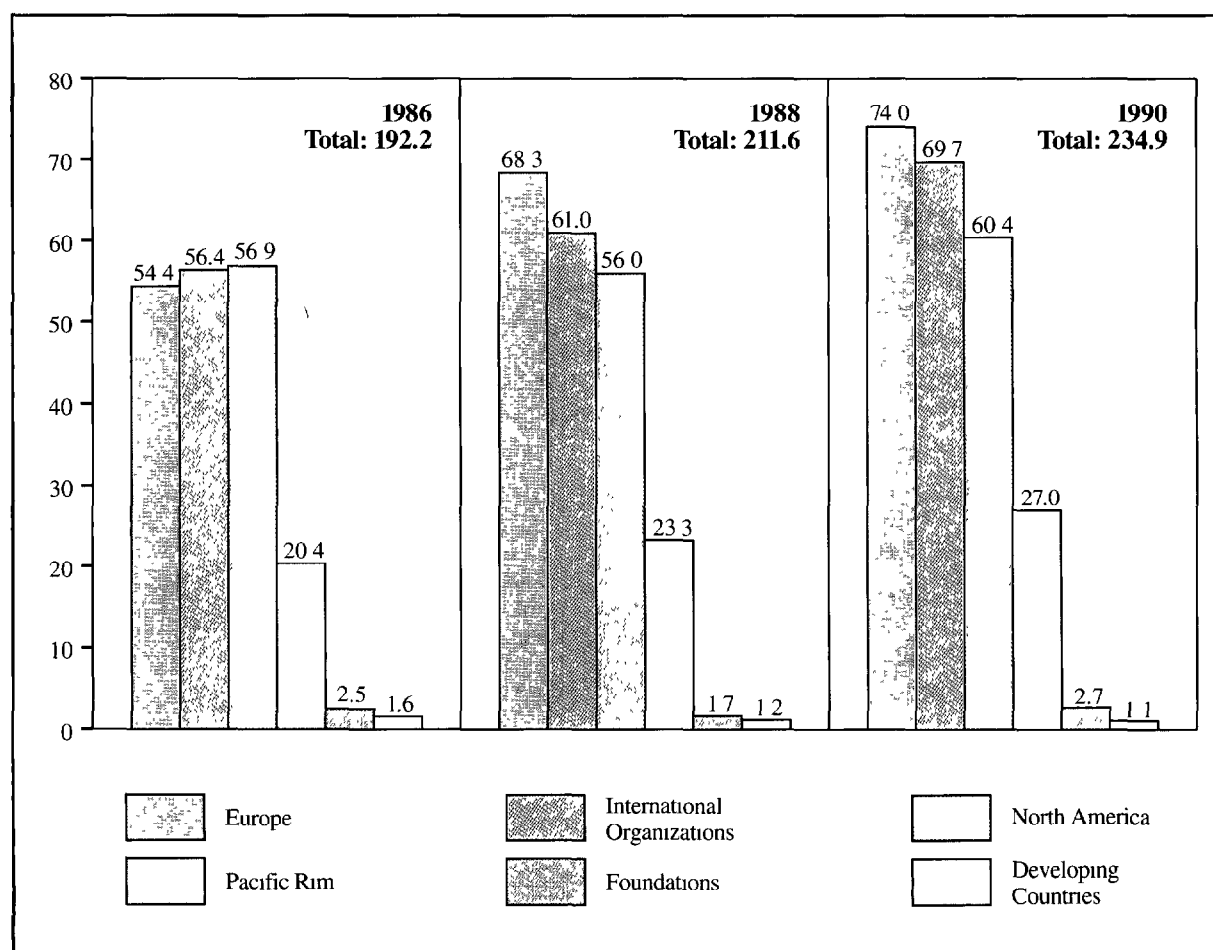
tary funding came from donors who are not CGIAR members.

Assessing the centers' total program funding, excluding transfers from the stabilization fund, \$194.5 million or 68 percent (70 percent in 1989) of the contributions are unrestricted and \$91.9 million or 32 percent (30 percent in 1989) were restricted/project-type funding.

As the balancing donor in the CGIAR, the World Bank contributed \$34.3 million after the other donors' funding intentions were known.

Note Totals in text and tables are computer-rounded

Figure 1 CGIAR Core Contributions by Donor Group, 1986–1990 (in US\$ millions)



Only one center (five in 1989) needed 10 percent or less of its revised requirements from the Bank; six centers (same as 1989) needed from 11 to 20 percent of revised requirements; and six centers (two in 1989) exceeded 21 percent of revised requirements.

In 1990, \$2.5 million was advanced from the stabilization fund to the centers to assure the funding of their core programs as revised in January. The stabilization fund was established in 1984 to protect centers from exchange rate and inflation risks. There were no payments from the stabilization mechanism for exchange loss claims or claims related to inflation. The 1990 starting balance in the fund was \$6.2 million. Interest earned was \$1 million. With the transfer of the \$2.5 million, the year-end balance was \$4.7 million. Refinancing in 1991 is expected to restore the fund to its 1989 level.

Expenditures

Total expenditures at year's end amounted to \$304.2 million or \$4.1 million (1 percent) below total funding available. This represented an increase of 5 percent over 1989, an increase in real terms of 0.4 percent. Of the \$304.2 million, \$249.5 million were spent on core programs and \$54.6 million on complementary programs, including capital expenditures of \$17.6 million and \$7.4 million respectively (Table 2). The \$4.1 million underrun allowed several centers to strengthen their operating funds. However in several cases, accumulated operating funds were drawn on to finance overspending in both core and complementary programs. Both higher than planned capital expenditures (by \$5.4 million) and the underrun at the expense of the operating programs are a reflection

Figure 2 1990 Core Operating Expenditures, Total and Research Program Components

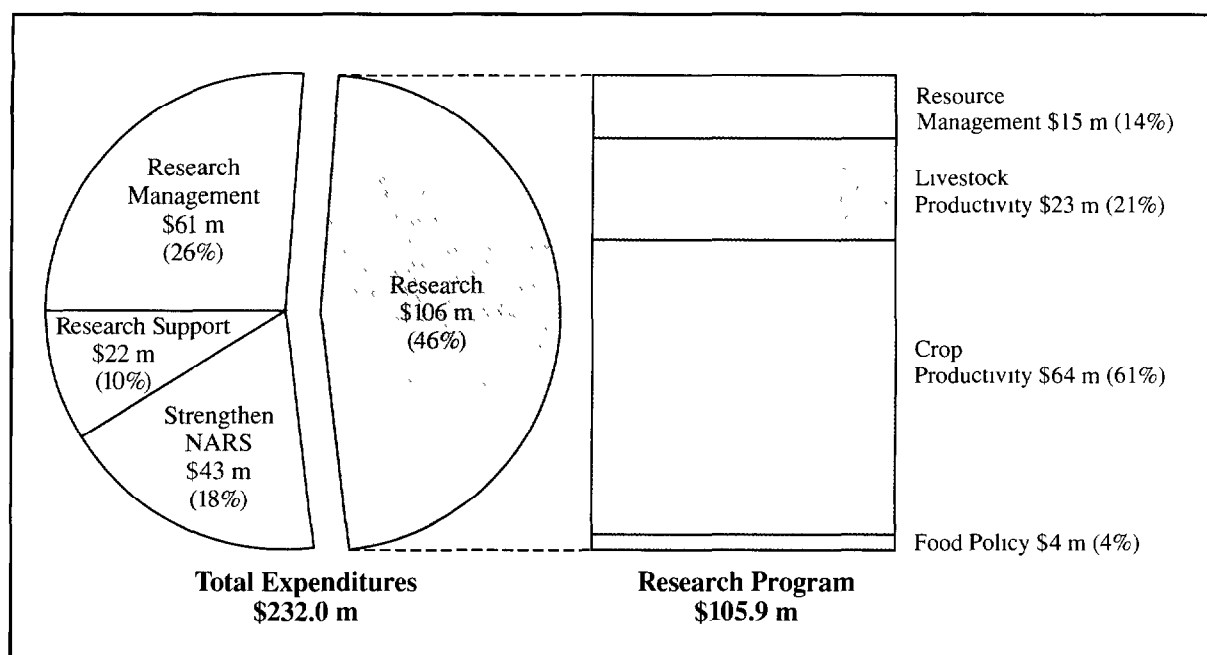


Table 2 CGIAR Core Operating Expenditures by Center, 1988–1990
(in US\$ millions)

<i>CENTER</i>	<i>1988</i>	<i>1989</i>	<i>1990</i>
CIAT	23.05	26.61	26.29
CIMMYT	24.97	25.12	24.69
CIP	13.05	16.56	16.98
IBPGR	6.24	7.02	7.20
ICARDA	20.40	23.85	21.83
ICRISAT	24.01	28.25	29.95
IFPRI	8.22	8.75	9.18
IITA	17.23	18.85	20.57
ILCA	16.09	19.49	20.74
ILRAD	12.28	11.15	12.38
IRRI	26.72	27.48	27.79
ISNAR	6.03	7.18	8.23
WARDA	5.30	6.43	6.15
Subtotal	203.59	223.81	231.99
<u>Memo:</u>			
1. Core Capital Expenditures	16.50	18.00	17.55
2. Complementary Expenditures	36.31	47.77	54.64

Table 3 Core Operating Expenditures by Program/Sub-Program (in US\$ millions)

	<i>1988</i>	<i>1989</i>	<i>1990</i>
RESEARCH			
Crop Productivity			
Cereals	40.16	42.55	41.25
Food Legumes	10.98	12.10	12.85
Roots and Tubers	<u>7.73</u>	<u>10.01</u>	<u>10.19</u>
	58.87	64.66	64.29
Food Policy	4.07	4.28	4.19
Livestock Productivity	20.90	21.38	22.72
Resource Management	<u>12.59</u>	<u>13.85</u>	<u>14.71</u>
Subtotal	96.43	104.17	105.91
STRENGTHENING NATIONAL SYSTEMS			
Information/Communication	11.34	13.13	12.06
Institution Building	3.51	4.21	5.61
Training/Conferences	18.02	16.57	15.83
Networks	<u>5.10</u>	<u>6.55</u>	<u>9.34</u>
Subtotal	37.97	40.46	42.84
RESEARCH SUPPORT			
Subtotal	18.75	22.23	22.11
RESEARCH MANAGEMENT			
Administration	29.31	32.65	35.91
General Operations	21.14	24.30	23.07
Non-Recurrent Expense	<u>—</u>	<u>—</u>	<u>2.14</u>
Subtotal	50.45	56.95	61.12
Total Operations	203.59	223.81	231.99

of the centers' cautious management during the year due to the pervading uncertainty of funding.

The system's actual spending pattern for core programs varied somewhat from both the 1990 revised plan and the 1989 actual. For example, research was 1.5 percent below revised 1990 and 3 percent in real terms below 1989 actual. Strengthening of national systems was 5.6 percent below revised plan; however, it was 1 percent above 1989 actual. Research support declined by 3.2 and 5.1 percent respectively compared to revised 1990 plan and actual 1989. These three categories represented 74 percent of total operating expenditures (Figure 2); 46 percent for research, 18 percent for strengthening national systems,

and 10 percent for research support. Expenditures by commodities are illustrated in Figure 3. Core operating expenditures by geographic region are illustrated in Figure 4.

Research management was 7 percent higher than revised plan and 2.4 percent higher than 1989 actual. This included a one-time exceptional expense (\$2.14 million). Excluding this provision, research management was still 3.3 percent over the revised level and 1.2 percent below the 1989 actual. Its adjusted share in total operating expenditures remained at the 1989 level of about 25 percent.

For more detailed information on the research commodity/activity comparison with previous years refer to Table 3.

Figure 3 1990 Crop Productivity Expenditures (in US\$ millions)

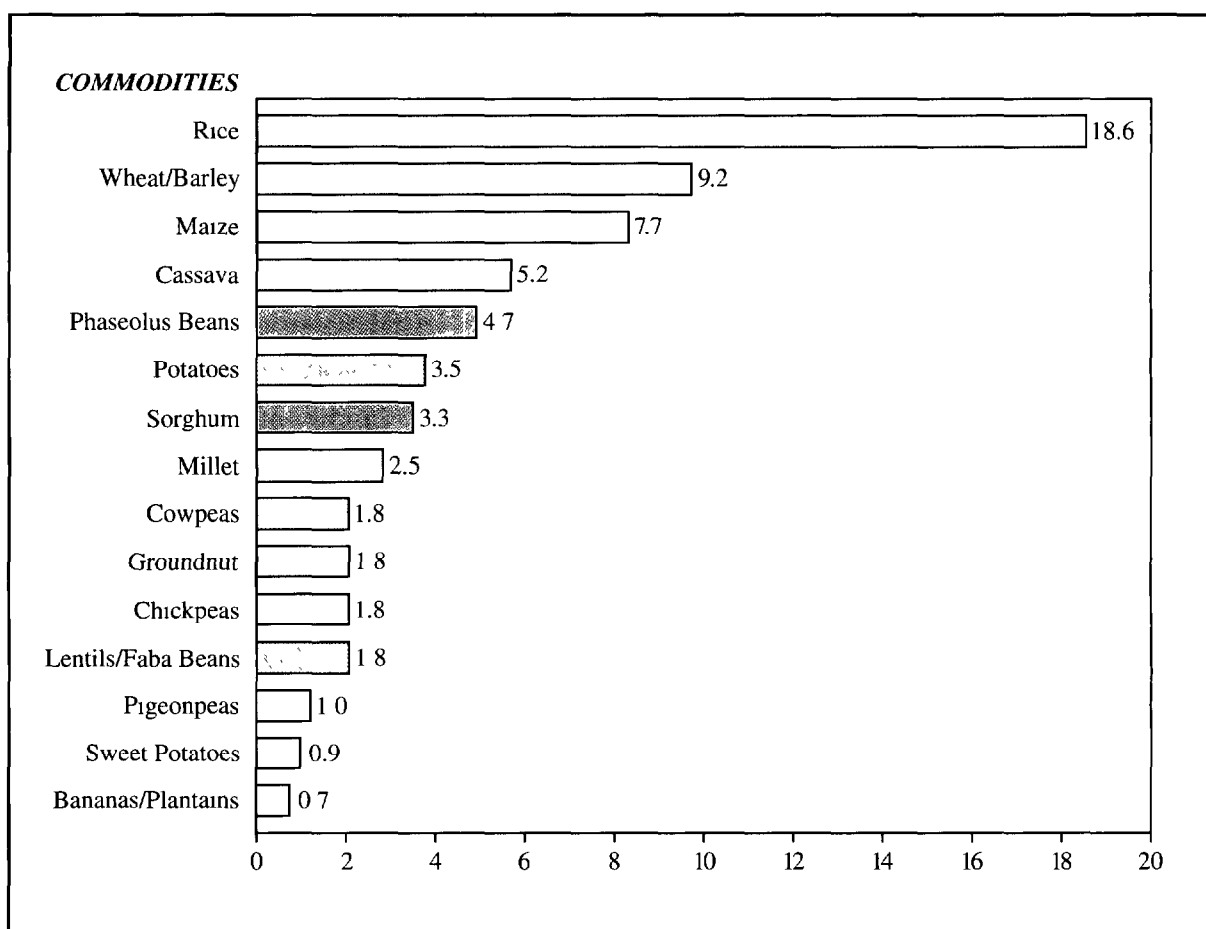
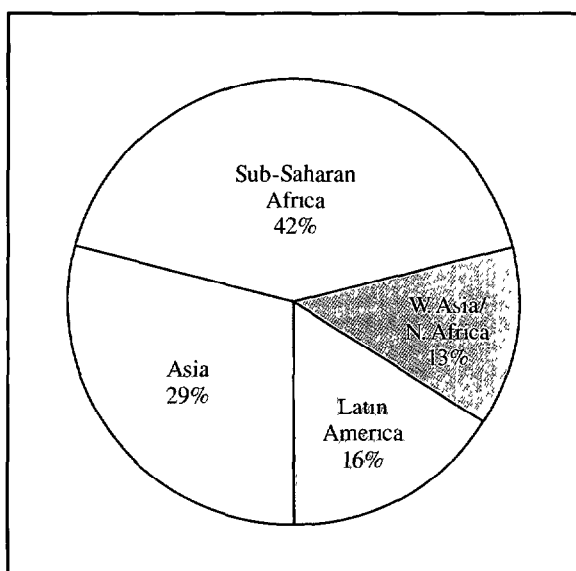


Figure 4 1990 Core Operating Expenditures by Region (in percentages)



Annex 1 CGIAR Core Contributions by Donor, 1987–90^a (in millions of units)

		<i>1987</i>		<i>1988</i>		<i>1989</i>		<i>1990</i>	
		<i>Natl. Currency</i>	<i>Equiv. in US\$</i>	<i>Natl. Currency</i>	<i>Equiv. in US\$</i>	<i>Natl. Currency</i>	<i>Equiv. in US\$</i>	<i>Natl. Currency</i>	<i>Equiv. in US\$</i>
<i>Countries</i>									
Australia	(Aus \$)	4.40	2.92	4.27	3.13	4.33	3.70	4.80	3.81
Austria	(US \$)	—	1.00	—	1.00	—	0.98	—	1.00
Belgium	(Bfr)	92.29	2.74	99.93	2.53	89.23	2.50	100.59	3.16
Brazil	(US \$)	—	—	—	0.02	—	0.05	—	0.01
Canada	(Can \$)	15.80	11.79	16.90	13.76	15.75	13.21	16.05	13.97
	(US \$)	—	—	—	—	—	1.16	—	1.38
China	(US \$)	—	0.30	—	0.30	—	0.30	—	0.30
Denmark	(Dkr)	16.01	2.26	17.80	2.53	19.20	2.64	21.65	3.57
Finland	(Markka)	9.00	2.29	11.00	2.74	21.80	5.16	21.40	5.31
France	(FF)	19.59	3.22	21.00	3.30	20.89	3.60	21.00	4.10
Germany	(DM)	19.30	10.38	18.99	10.81	20.84	11.18	18.49	11.21
India	(US \$)	—	0.50	—	0.50	—	0.50	—	0.50
Ireland	(Punt)	0.47	0.69	0.10	0.16	0.19	0.28	0.20	0.31
Italy	(Lire)	5000.00	4.14	5000.00	3.61	5300.00	3.79	2000.49	1.71
	(US \$)	—	5.94	—	4.48	—	5.70	—	4.39
Japan	(Yen)	2544.84	17.98	2591.83	20.21	2876.00	19.87	3019.63	23.19
Mexico	(US \$)	—	0.10	—	—	—	—	—	—
Netherlands	(Dfl)	11.32	5.60	12.10	6.26	11.81	5.43	12.40	6.89
Nigeria	(Naira)	0.75	0.18	0.75	0.12	—	0.02	0.65	0.09
Norway	(Nkr)	22.12	3.23	24.60	3.85	27.85	4.09	30.99	4.70
Philippines	(US \$)	—	0.26	—	0.25	—	0.18	—	0.20
Spain	(US \$)	—	0.50	—	0.50	—	0.50	—	0.50
Sweden	(Skr)	31.00	4.86	33.00	5.41	35.12	5.47	37.70	6.20
Switzerland	(Sfr)	7.75	4.88	7.27	5.40	8.67	5.57	8.95	5.91
	(US \$)	—	2.82	—	4.19	—	3.96	—	3.47
United Kingdom	(Pound)	6.29	10.27	6.48	11.51	6.52	10.87	6.60	11.57
United States	(US \$)	—	40.22	—	40.00	—	40.00	—	45.09
	(US \$)	—	—	—	2.22	—	4.14	—	—
Subtotal			139.07		148.79		154.85		162.53

	1987		1988		1989		1990	
	Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$	Natl. Currency	Equiv. in US\$
<i>Foundations</i>								
Ford Foundation (US \$)	—	0.94	—	0.79	—	0.79	—	0.94
Rockefeller Foundation (US \$)	—	0.88	—	0.93	—	1.89	—	1.74
Subtotal		1.82		1.72		2.68		2.69
<i>International Organizations</i>								
African Development Bank (UC)	0.50	0.71	0.50	0.72	0.85	1.14	—	1.23
Arab Fund (Dinar)	0.10	0.37	0.10	0.35	0.15	0.51	—	—
Asian Development Bank (US \$)	—	—	—	—	—	0.03	—	0.63
EEC (ECU)	6.90	8.12	6.90	7.99	8.50	9.45	11.05	14.79
(US \$)	—	1.00	—	1.20	—	2.39	—	0.62
IDB (US \$)	—	10.28	—	10.55	—	11.13	—	10.50
IDRC (Can \$)	1.21	0.81	0.77	0.63	0.75	0.63	0.91	0.78
IFAD (US \$)	—	0.25	—	0.28	—	0.52	—	0.50
OPEC Fund (US \$)	—	0.51	—	0.28	—	0.30	—	—
UNDP (US \$)	—	8.68	—	8.99	—	7.52	—	6.33
UNEP (US \$)	—	—	—	0.05	—	0.03	—	—
World Bank (US \$)	—	30.00	—	30.00	—	33.34	—	34.33
Subtotal		60.73		61.04		66.99		69.71
Total Contributions		201.62		211.55^b		224.52		234.93
<i>Memo Items:</i>								
Contribution in US \$		97.98		101.91		109.58		118.53
(Percentage of total)		49%		48%		49%		50%
Cumulative disbursements by quarters (%)								
Quarter 1		20		20		19		16
Quarter 2		45		42		38		34
Quarter 3		81		77		74		56
Quarter 4		92		94		92		92

a. Includes complementary projects reclassified as core

b. Excludes \$0.240 million previously reported as "Other Donors' Core Contributions "



